Williams®

16P-3001T-101
May, 1981

DEFENDER



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Williams® ELECTRONICS, INC.

3401 N. California Ave., Chicago, IL 60618
Cable Address: WILCOIN, CHICAGO
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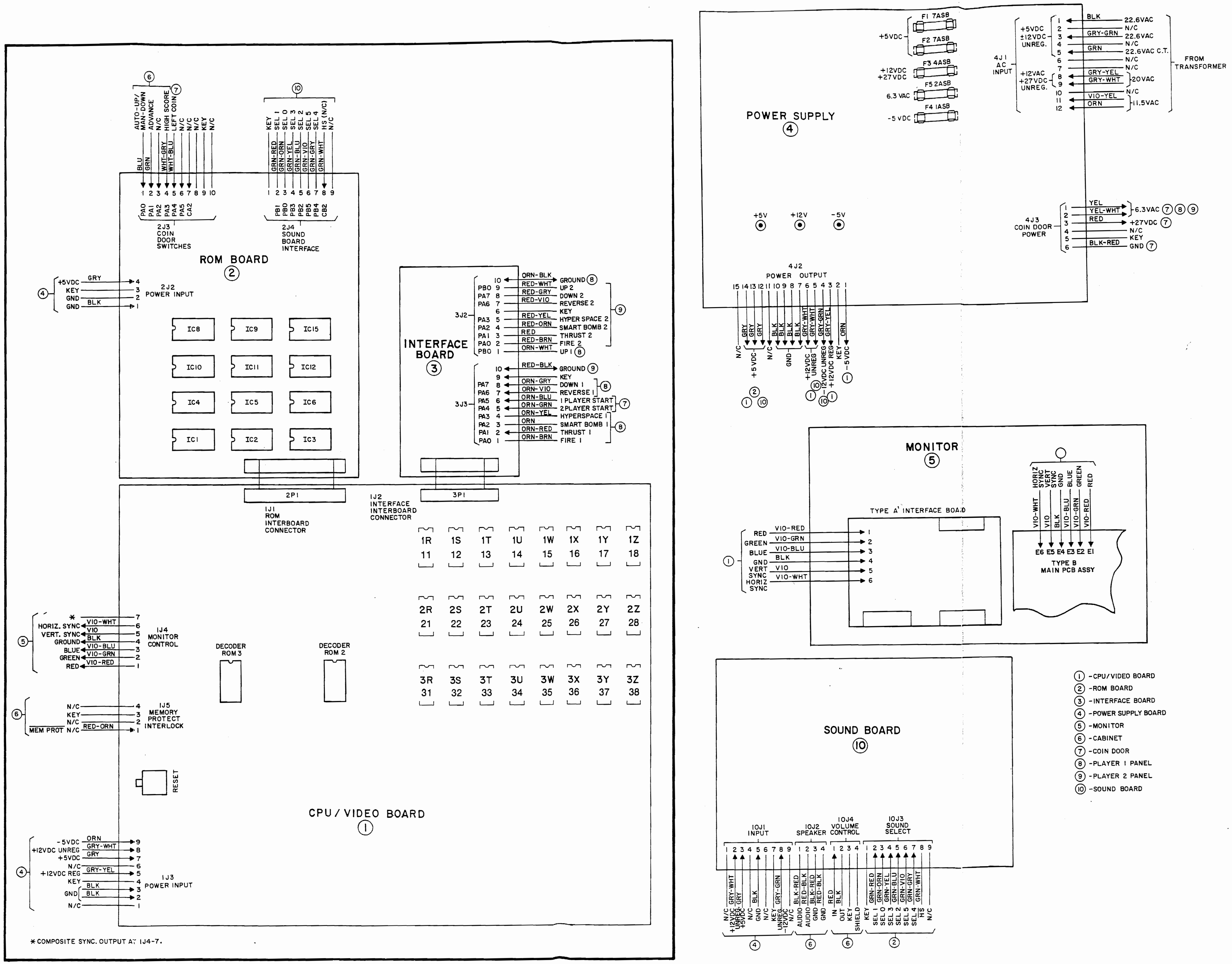
SPECIAL NOTES

CPU/Video Board
Model R8570 equipped with two decoder ROMs, must be used.

Interface Board
Jumper W1 must be removed and jumper W2 must be connected.

ROM Board
Must be equipped with red-labeled ROMs.

CONTENTS



Interboard Wiring Diagram



1J1
1J2
1J3
1J4
1J5
SW1
B1
B2
B3
CR1
2I
3E
3K
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
Ø 1 2 3 4 5 6 7

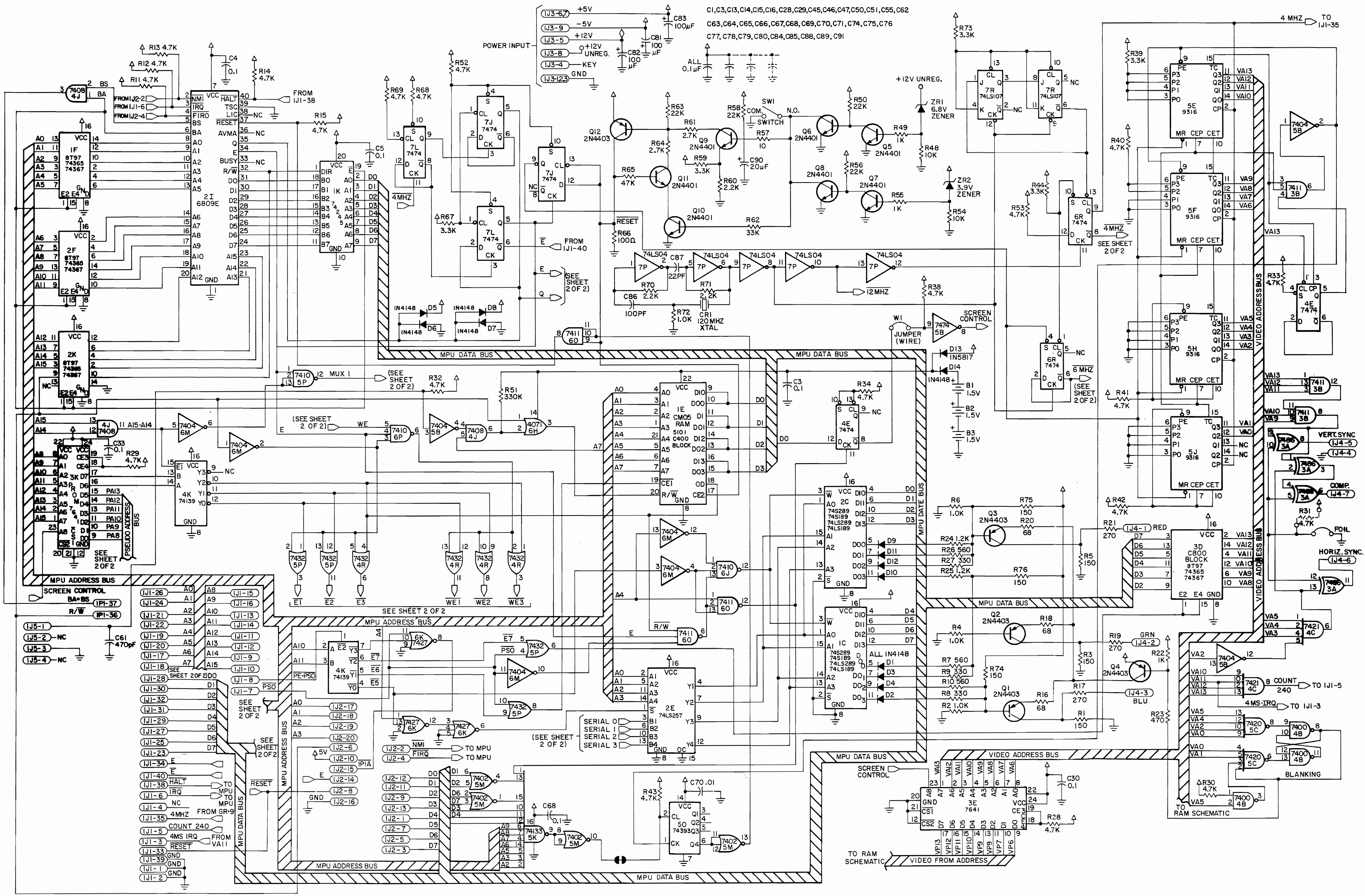
NOTES:

1. 4116: 1R, 1S, 1T, 1U, 1W, 1X, 1Y, 1Z, 2R, 2S, 2T, 2U, 2W, 2X, 2Y, 2Z, 3R, 3S, 3T, 3U, 3W, 3X, 3Y, 3Z
2. 4.7K RESISTOR: R11, R12, R13, R14, R15, R28, R29, R30, R31, R32, R33, R34, R35, R36, R37, R38, R40, R41, R42, R43, R45, R46, R47, R52, R53, R68, R69
3. .1 MFD. CAPACITOR: C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26, C27, C28, C29, C30, C31, C32, C33, C34, C35, C36, C37, C38, C39, C40, C41, C42, C43, C44, C45, C46, C47, C48, C49, C50, C51, C52, C53, C54, C55, C56, C57, C58, C59, C60, C62, C63, C64, C65, C66, C67, C68, C69, C70, C71, C72, C73, C74, C75, C76, C77, C78 C79, C80, C84, C85, C88, C89, C91
4. IN4148 DIODE: D1, D2, D3, D4, D5, D6, D7, D8, D9, D10, D11, D12, D14
5. *- THESE COMPONENTS ARE NOT USED IN THIS GAME - DEFENDER.

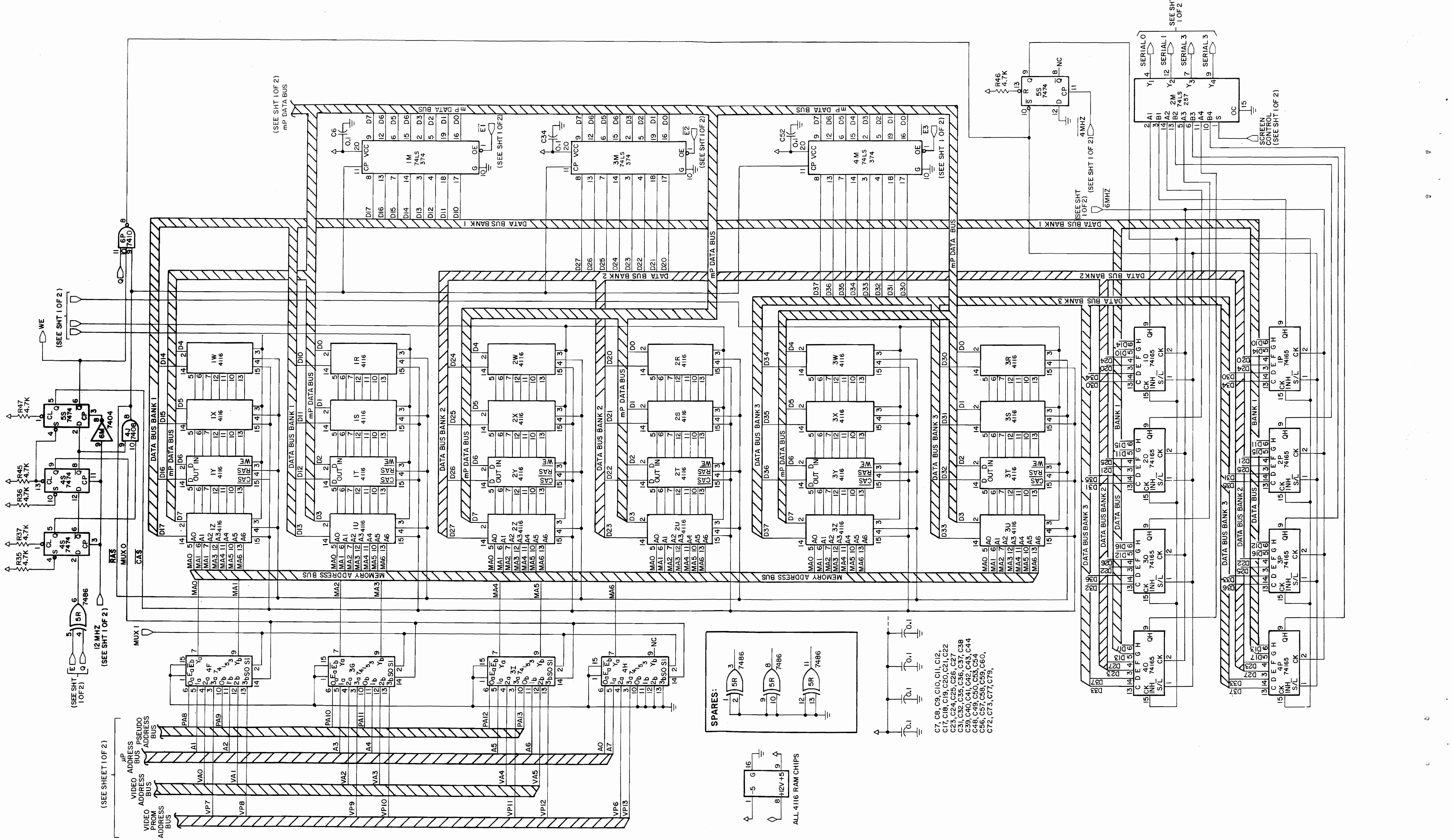
ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
76	5010-09508-00	R17, R19, R21	RESISTOR, C.F., 270 OHM 2% 1/4 W.	3
77	5010-09534-00	W1	RESISTOR, C.F., 0 OHM	1

BILL OF MATERIAL

ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
1	5770-09616-00	—	BARE P.C. BOARD	1
2	5280-09073-00	4B	7400 QUAD 2-INPUT NAND	1
3	5280-08948-00	5M	7402 QUAD 2-INPUT NOR	1
4	5281-09215-00	7P	74LS04 HEX. INVERTER	1
5	5280-09013-00	5B, 6M	7404 HEX. INVERTER	2
6	5280-08973-00	4J	7408 QUAD AND	1
7	5280-09011-00	6J, 6P	7410 TRIPLE 3-INPUT NAND	2
8	5280-09475-00	3B, 6O	7411 TRIPLE 3-INPUT AND	2
9	5280-09530-00	5C	7420 DUAL 4-INPUT NAND	1
10	5280-09476-00	4C	7421 DUAL 4-INPUT AND	1
11	5280 09477-00	4R, 5P	7432 QUAD 2-INPUT OR	2
12	5280-09478-00	4E, 6R, 7J, 7L	7474 DUAL-D TYPE FLIP-FLOP	4
13	5280-09479-00	3A, 5R	7486 QUAD 2-INPUT EX-OR	2
14	5281-09480-00	7R	74LS107 DUAL J-K FLIP-FLOP	1
15	5281-09532-00	5K	74LS133 13-INPUT NAND	1
16	5281-09246-00	4K	74LS139 DUAL 2 to 4 LINE DECODER	1
17	5280-09481-00	3G, 3I, 4F, 4H	74153 DUAL 4 to 1 DATA INVERT	4
18	5280-09482-00	1O, 2O, 3O, 4O, 1P, 2P, 3P, 4P	74165 8-BIT SHIFT REGISTER	8
19	5281-09483-00	1C, 2C	74LS89 or 74LS189 or 74LS289 16x4 RAM	2
20	5281-09308-00	1K	74LS245 OCTAL BUS TRANSCEIVER	1
21	5281-09485-00	2E, 2M	74LS257 QUAD DATA MULPX.	2
22	5370-08989-00	1F, 2F 2K, 3D	8T97 HEX. TS BUFFER	4
22	5281-09385-00		74LS367 HEX BUS DRIVER	∩
23	5281-09486-00	1M, 3M, 4M	74LS374 OCTAL D-TYPE FLIP-FLOP	3
24	5281-09487-00	4S, 5S	74LS74 DUAL D-TYPE FLIP-FLOP	2
25	5281-09533-00	5O	74LS393 DUAL 4-BIT BIN. COUNTER	1
26	5342-09015-00	3E, 3K	7641 512 x 8 PROM	2
27	5310-09287-00	6H	4071 CMOS QUAD 2-INPUT NOR	1
28	5340-09488-00	SEE NOTE #1	4116 (450 ns ACCESS) 16K x 1 DYNAMIC RAM	24
29	5340-09017-00	1E	5101 256 x 4 CMOS RAM	1
30	5280-09489-00	5E, 5F, 5H, 5J	9316 4-BIT BIN. COUNTER	4
31	5400-09490-00	2I	6809E MICROPROCESSOR	1
32	5280 09547-00	6K	7427 TRIPLE 3-INP. POS-NOR GATE	1
33	5010 09548-00	R16, R18, R20	RESISTOR, C.F. 68 OHM 2% 1/4 W.	3
34	5010-09036-00	R66	RESISTOR, C.F. 100 OHM 5% 1/4 W.	1
35	5010-09187-00	R1, R3, R5, R74, R75, R76	RESISTOR, C.F. 150 OHM 5% 1/4 W.	6
36	5010-09416-00	R23	RESISTOR, C.F. 470 OHM 5% 1/4 W.	1
37	5010-08992-00	R7, R10, R26	RESISTOR, C.F. 560 OHM 5% 1/4 W.	3
38	5010-09358-00	R2, R4, R6, R22, R49, R55, R72	RESISTOR, C.F. 1K OHM 5% 1/4 W.	7
39	5010-09314-00	R24, R25	RESISTOR, C.F. 1.2K OHM 5% 1/4 W.	2
40	5010-08998-00	R60, R70, R71	RESISTOR, C.F. 2.2K OHM 5% 1/4 W.	3
41	5010-08997-00	R61, R64	RESISTOR, C.F. 2.7K OHM 5% 1/4 W.	2
42	5010-08983-00	R39, R44, R59, R67, R73	RESISTOR, C.F. 3.3K OHM 5% 1/4 W.	5
43	5010-08991-00	SEE NOTE #2	RESISTOR, C.F. 4.7K OHM 5% 1/4 W.	27
44	5010-09034-00	R48, R54	RESISTOR, C.F. 10K OHM 5% 1/4 W.	2
45	5010-08774-00	R50, R56, R58, R63	RESISTOR, C.F. 22K OHM 5% 1/4 W.	4
46	5010-09113-00	R62	RESISTOR, C.F. 33K OHM 5% 1/4 W.	1
47	5010-09359-00	R65	RESISTOR, C.F. 47K OHM 5% 1/4 W.	1
48	5010-09442-00	R51	RESISTOR, C.F. 330K OHM 5% 1/4 W.	1
49	5010-09001-00	R8, R9, R27	RESISTOR, C.F. 330 OHM 5% 1/4 W.	3
50	5010-09039-00	R57	RESISTOR, C.F. 10 OHM 5% 1/4 W.	1
51	5043-09491-00	C87	CAPACITOR, AXIAL 22 PFD. 1K V. ±10%	1
52	5043-09492-00	C86	CAPACITOR, AXIAL 100 PFD. 50 V. ±10%	1
53	5040-09545-00	C90	CAPACITOR, AXIAL 22 MFD. 10 V. ±20%	1
54	5043-09065-00	C61	CAPACITOR, AXIAL 470 PFD. 50 V. X7R	1
55	5043-08996-00	SEE NOTE #3	CAPACITOR, AXIAL .1 MFD. 50 V. ±20%	84
56	5040-09421-00	C81, C82, C83	CAPACITOR, RADIAL 100 MFD. 25 V. +50 -10%	3
57	5075-09059-00	ZR2	IN5990A 3.9 V. ZENER DIODE	1
58	5075-09018-00	ZR1	IN5996A 6.8 V. ZENER DIODE	1
59	5070-08919-00	SEE NOTE #4	IN4148 DOIDE, SILICON	13
60	5070-09266-00	D13	IN5817 DOIDE, SILICON	1
61	5160-08958-00	Q5, Q6, Q7, Q8, Q9, Q10, Q11	2N4401, TO-92 TRANSISTOR, NPN	7
62	5190-09016-00	Q1, Q2, Q3, Q4, Q12	2N4403, TO-92 TRANSISTOR, PNP	5
63	5520-09495-00	CR1	12 MHZ CRYSTAL	1
64	5641-09371-00	SW1	PUSH BUTTON SW. DPST (MOMENTARY ON)	1
65	5880-09022-00	B1, B2, B3	BATTERY ALKALINE 1.5 V. (AA)	3
66	5881-09021-00	—	BATTERY HOLDER #171	1
67	5700-09006-00	—	16-PIN IC SOCKET	24
68	5700-09004-00	—	24-PIN IC SOCKET	2
69	5700-08985-00	—	40-PIN IC SOCKET	1
70	5791-09437-00	1P4	20 PIN RIBBON CABLE HEADER	1
71	5791-09349-00	1P1	40 PIN RIBBON CABLE HEADER	1
72				
73	5791 09028-00	1P5	4 PIN HEADER 09-65-1041	1
74	5791-09497-00	1P2	7 PIN HEADER 09-65-1071	1
75	5791-[illegible]	1P3	9 PIN HEADER 09-65-1091	1

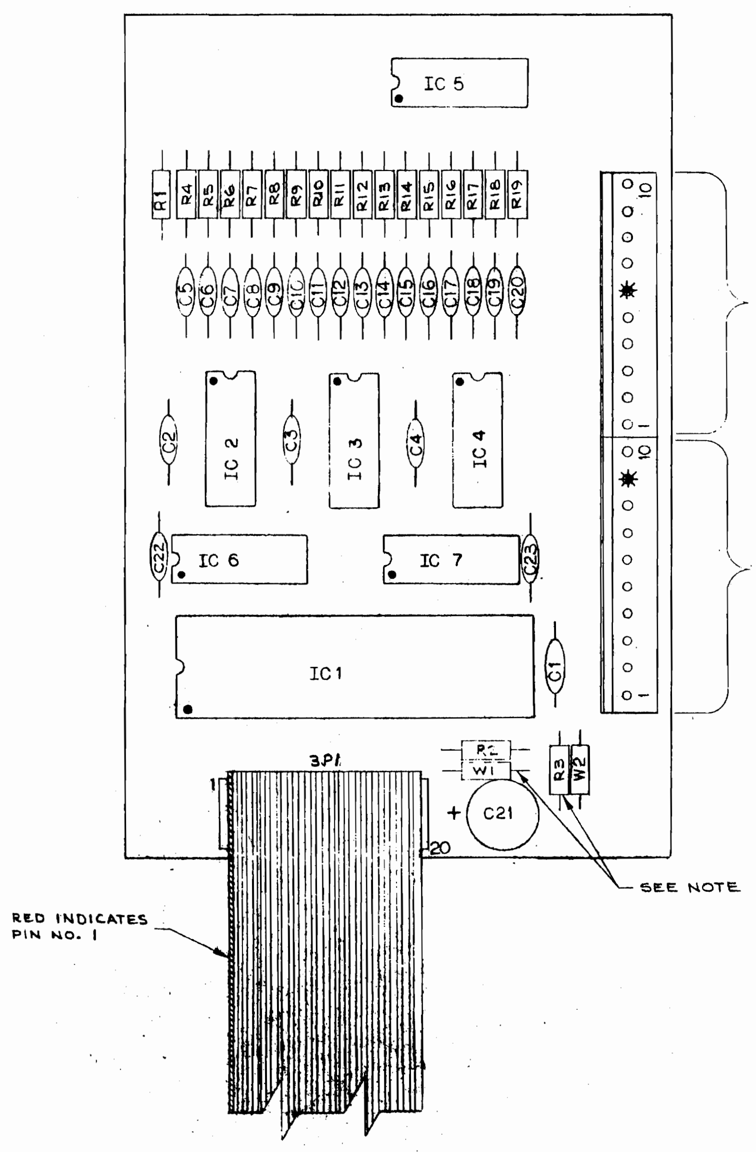


R8570 CPU/Video Board Logic Diagram
(Sheet 1 of 2)



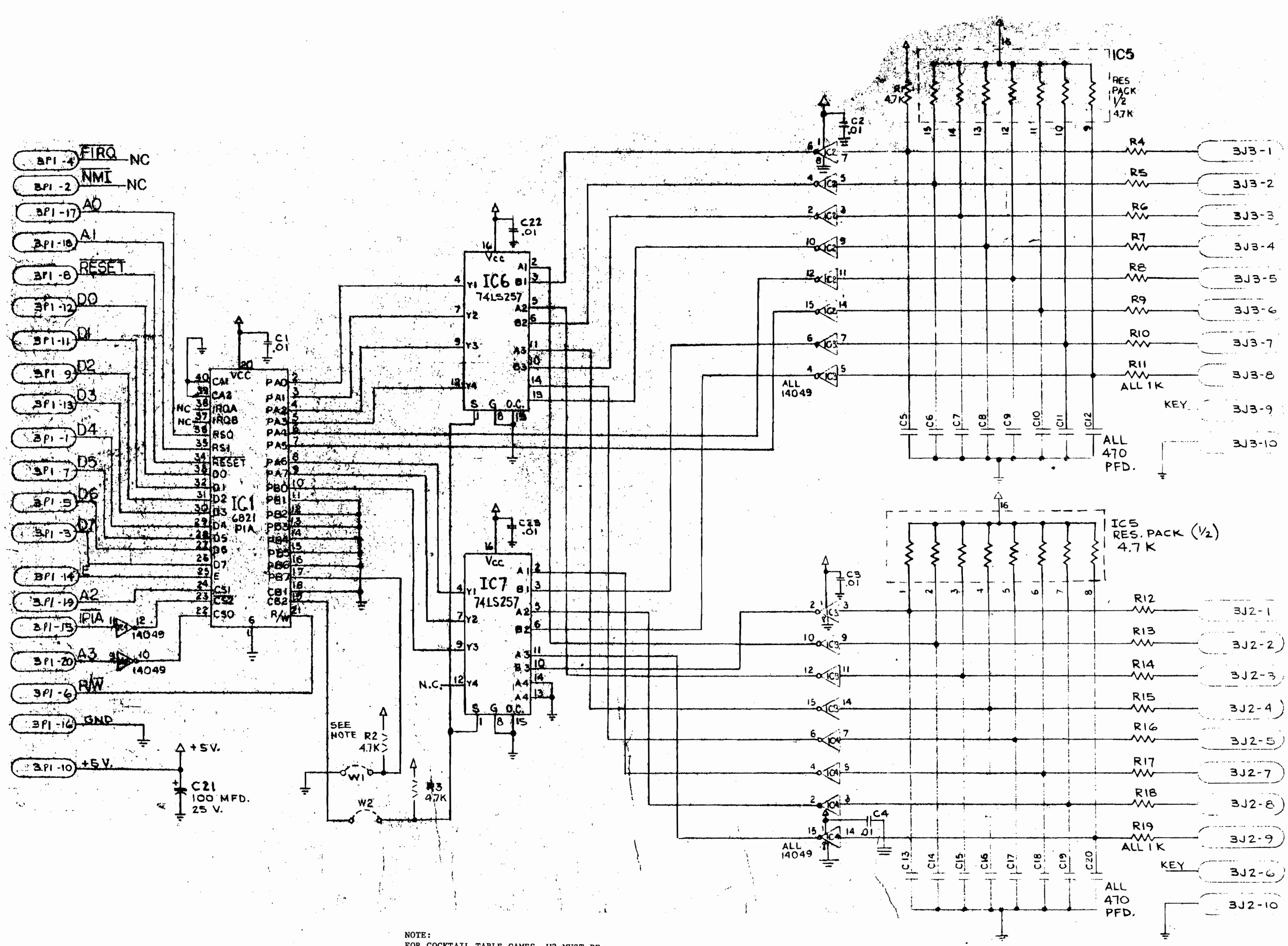
R8570 CPU/Video Board Logic Diagram
(Sheet 2 of 2)

BILL OF MATERIALS				
ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	NO REQ'D
1	5772-09614-00		BARE P.C. BOARD	1
2	5310-08975-00	IC2.IC3.IC4	4049 CMOS HEX INVERTER	3
3	5019-09239-00	IC5	4.7KΩ 15 RES 16 PIN DIP PACK	1
4	5281-09485-00	IC6, IC7	74LS257 QUAD DATA MULTIPLEXER	2
5	5010-08991-00	R1, R2, R3	RESISTOR, F.C., 4.7 K OHM 5% 1/4 WATT	3
6	5010-09358-00	R4 THRU R19	RESISTOR, F.C., 1K OHM 5% 1/4 WATT	16
7	5043-09065-00	C5 THRU C20	CAPACITOR, CERAMIC DISC, 470 PFD. 50 V. X7R	16
8	5040-09421-00	C21	CAPACITOR, ELECTROLYTIC RAD., 100 MFD. 25 VOLT, +50-10%	1
9	5043-08980-00	C1, C2, C3, C4, C22, C23	CAPACITOR, CERAMIC DISC, .01 MFD. 50 V. +80-20%	6
10	5791-09444-00	3J2, 3J3	10 PIN HEADER 09-65-1101	2
11	5795-09540-00	3P1	20 PIN RIBBON CABLE ASSY	1
12	5430-08972-00	IC1	6821 PIA	1
13	3610-09534-00	W1, W2	0 Ω RESISTOR	2



NOTE:
FOR COCKTAIL TABLE GAMES, W2 MUST BE CONNECTED AND W1 MUST BE REMOVED.

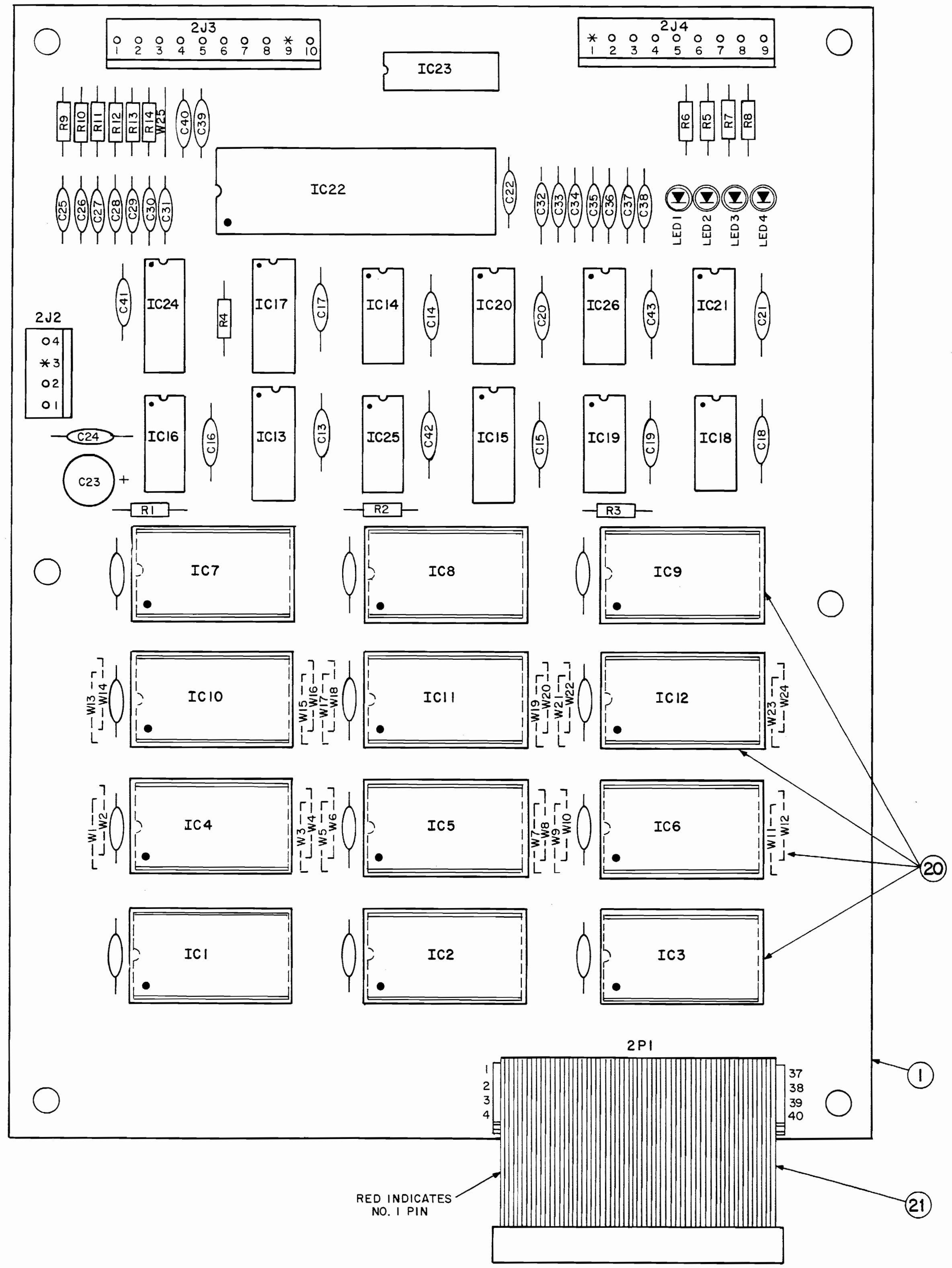
FOR UPRIGHT GAMES, W1 MUST BE CONNECTED. WITH RED-LABELED ROMS, W2 MAY BE CONNECTED OR REMOVED. WITH LABELS OF OTHER COLORS, W2 MUST BE REMOVED.



NOTE:
FOR COCKTAIL TABLE GAMES, W2 MUST BE CONNECTED AND W1 MUST BE REMOVED.

FOR UPRIGHT GAMES, W1 MUST BE CONNECTED. WITH RED-LABELED ROMS, W2 MAY BE CONNECTED OR REMOVED. WITH LABELS OF OTHER COLORS, W2 MUST BE REMOVED.

C8573 Interface Board Assembly and Logic Diagram



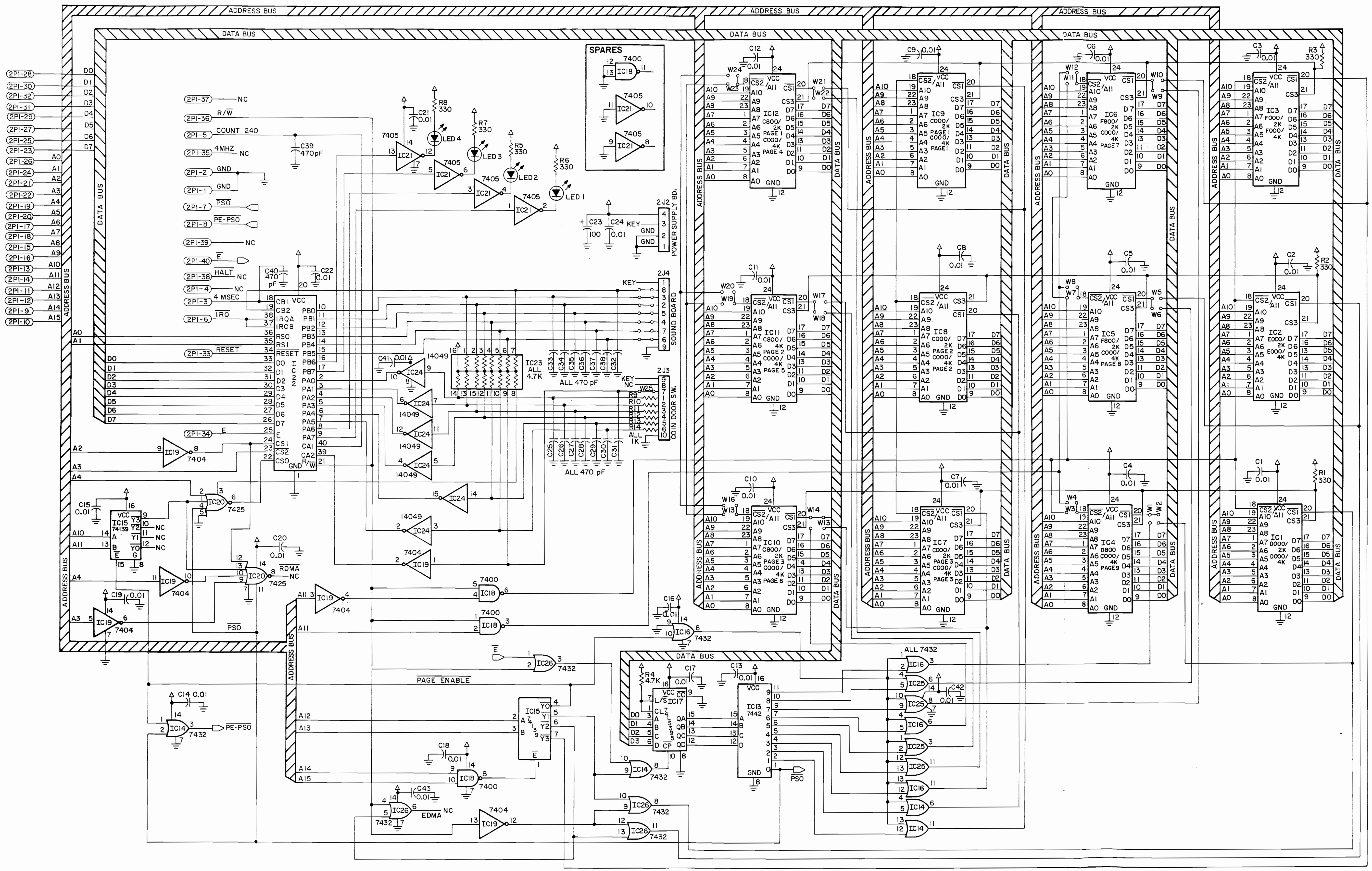
BILL OF MATERIALS				
ITEM	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D NO
1	5771-09615-00		BARE P.C. BOARD	1
2	5280-09012-00	IC13	7442 BCD DECODER	1
3	5280-09477-00	IC14, IC16, IC25, IC26	7432 QUAD 2-INPUT OR GATE	4
4	5281-09246-00	IC15	74LS139 DUAL 2 TO 4 LINE DECODER	1
5	5281-09501-00	IC17	74LS395 4-BIT UNIVERSAL SHIFT REG.	1
6	5280-09073-00	IC18	7400 QUAD 2 INPUT NAND	1
7	5280-09013-00	IC19	7404 HEX. INVERTERS	1
8	5280-09551-00	IC20	7425 DUAL 4 INPUT NOR GATES WITH STROBE	1
9	5280-08949-00	IC21	7405 HEX INVERTERS WITH OPEN-COLLECTOR OUTPUTS.	1
10	5430-08972-00	IC22	MC6821 PIA	1
11	5019-09239-00	IC23	4.7K 15 RES. 16 PIN DIP PACK	1
12	5671-09019-00	LED 1 THRU LED 4	LED RED	4
13	5010-09001-00	R1 THRU R3 R5 THRU R8	RESISTOR, FC, 330 OHM 5% 1/4 W	7
14	5010-08991-00	R4	RESISTOR, FC, 4.7K OHM 5% 1/4 W	1
15				
16	5043-08980-00	C1 THRU C16, C18 THRU C22, C41-C43	CAP. CERAMIC 0.01 MFD. 50V	24
17	5040-09421-00	C23	CAP. ELECT., 100 MFD. 25V	1
18	5043-08996-00	C24	CAP. CERAMIC 0.1 MFD	1
19	5043-09065-00	C17, C25 THRU C28	CAP. CERAMIC, 470 PFD. 50V AXIAL	17
20	5700-09004-00		24 PIN IC SOCKET	12
21	5795-09611-00	2P1	40 PIN RIBBON CABLE ASS'Y. 5"	1
22	5791-09028-00	2J2	4 PIN MALE CONNECTOR 09-65-1041	1
23	5791-09444-00	2J3	10 PIN MALE CONNECTOR 09-65-1101	1
24	5791-09027-00	2J4	9 PIN MALE CONNECTOR 09-65-1091	1
25	5310-08975-00	IC24	4049 INVERTING HEX. BUFFER	1
26	5010-09358-00	R9 THRU R14	RESISTOR, FC, 1K OHM 5% 1/4 W	6
27	5010-09534-00	W1 THRU W25	RESISTOR, FC, 0 OHM	AS REQ'D
28	SEE CHART	IC1 THRU IC12 SEE CHART	SEE CHART	AS REQ'D

GAME NAME	"DEFENDER" RED LABEL				
ASSEM. NO.	D-8572-3001				
IC1	A-5343-09636				
IC2	A-5343-09637				
IC3	A-5343-09638				
IC4	A-5343-09639				
IC5	NOT USED				
IC6	A-5343-09640				
IC7	A-5343-09641				
IC8	A-5343-09642				
IC9	A-5343-09643				
IC10	A-5343-09644				
IC11	A-5343-09645				
IC12	A-5343-09646				
JUMPERS	W2, W4, W6, W7, W9, W11, W13, W16, W17, W20, W21, W24				

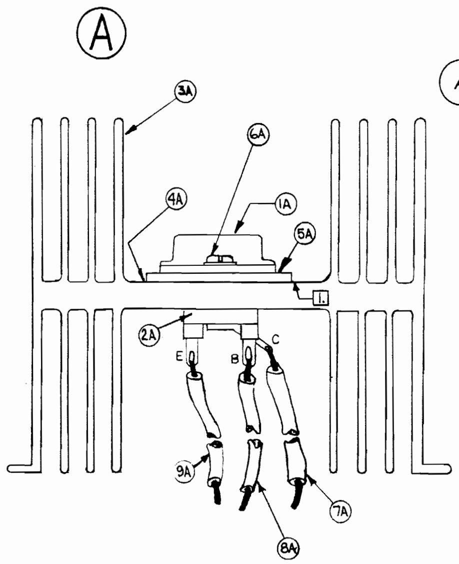
PART DESIGNATION

PART NUMBER

D8572 ROM Board Assembly Drawing



D8572 ROM Board Logic Diagram

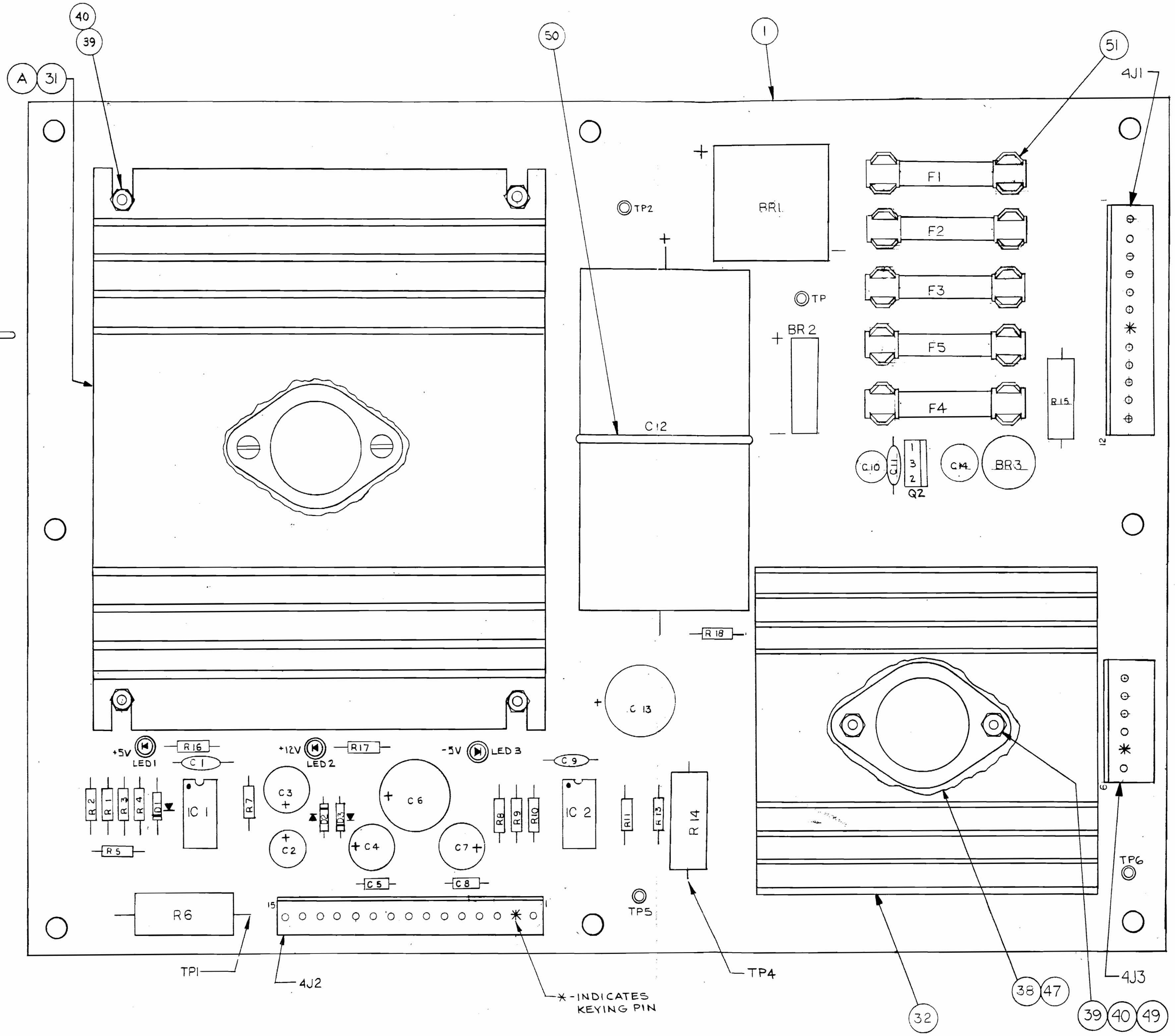


ITEM NO	PART NO	DESCRIPTION	REQ'D NO.
1A	5162-09425-00	TRANSISTOR NPN 2N6057	1
2A	5700-09445-00	TRANSISTOR-SOCKET T03	1
3A	5705-09431-00	HEATSINK	1
4A	20-9229-00	THERMAL COMPOUND 1.5 OUNCE	1
5A	5701-09538-00	T03 3MIL MICA INSULATOR	1
6A	4006-01003-8	MS-6-22x1/2-P-PH-S	2
7A	5853-09591-00	LEAD WIRE #18 AWG 4" 3/8 STRIPPED (GRN)	1
8A	5853-09592-00	LEAD WIRE #18 AWG-4" 3/8 STRIPPED (WHT)	1
9A	5853-09593-00	LEAD WIRE #18 AWG-4" 3/8 STRIPPED (YEL)	1

BILL OF MATERIAL

NOTES.

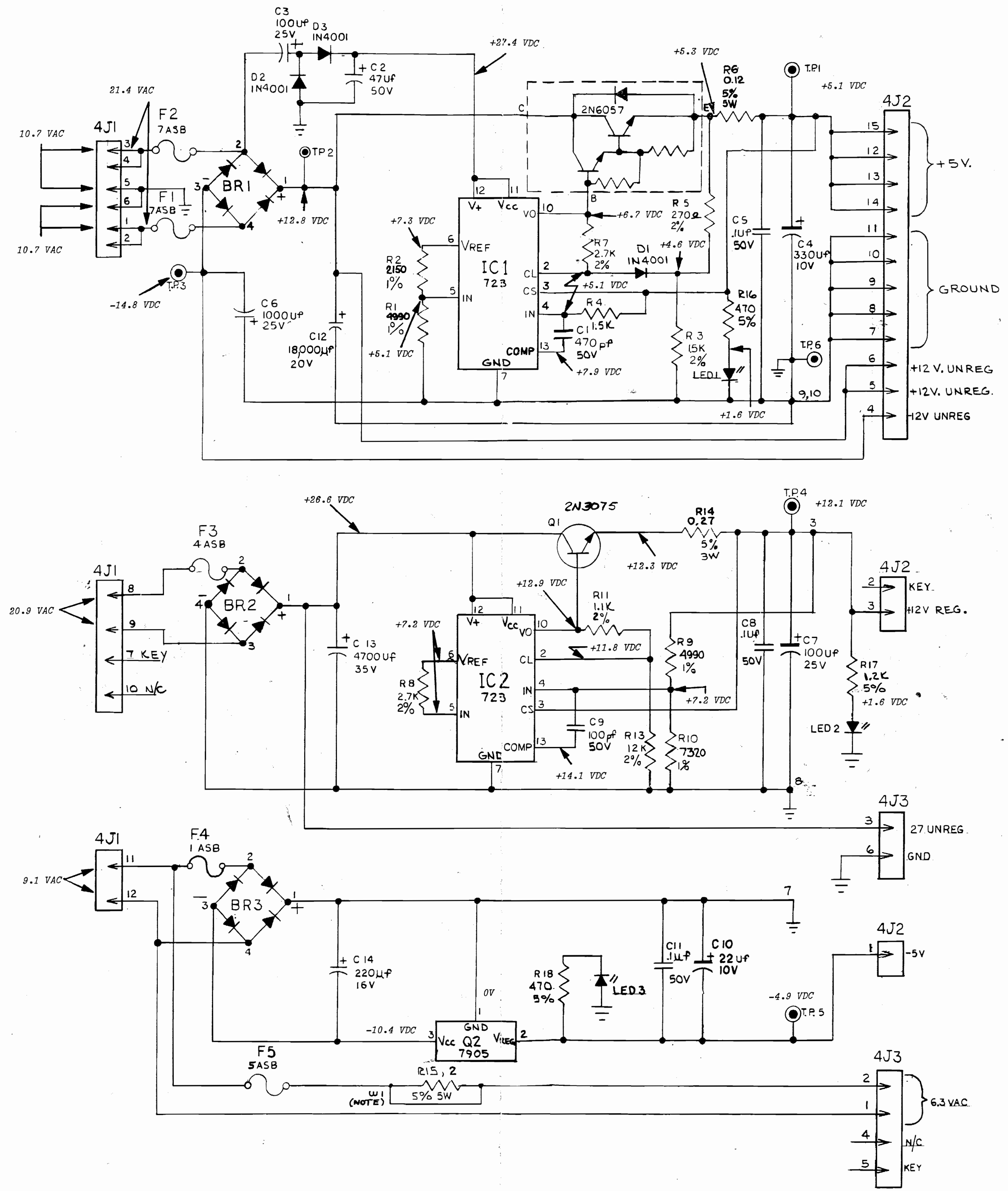
1. HEAT SINK COMPOUND MUST BE APPLIED BETWEEN MICA INSULATOR AND HEAT SINK AND BETWEEN MICA INSULATOR AND TRANSISTOR.



BILL OF MATERIAL

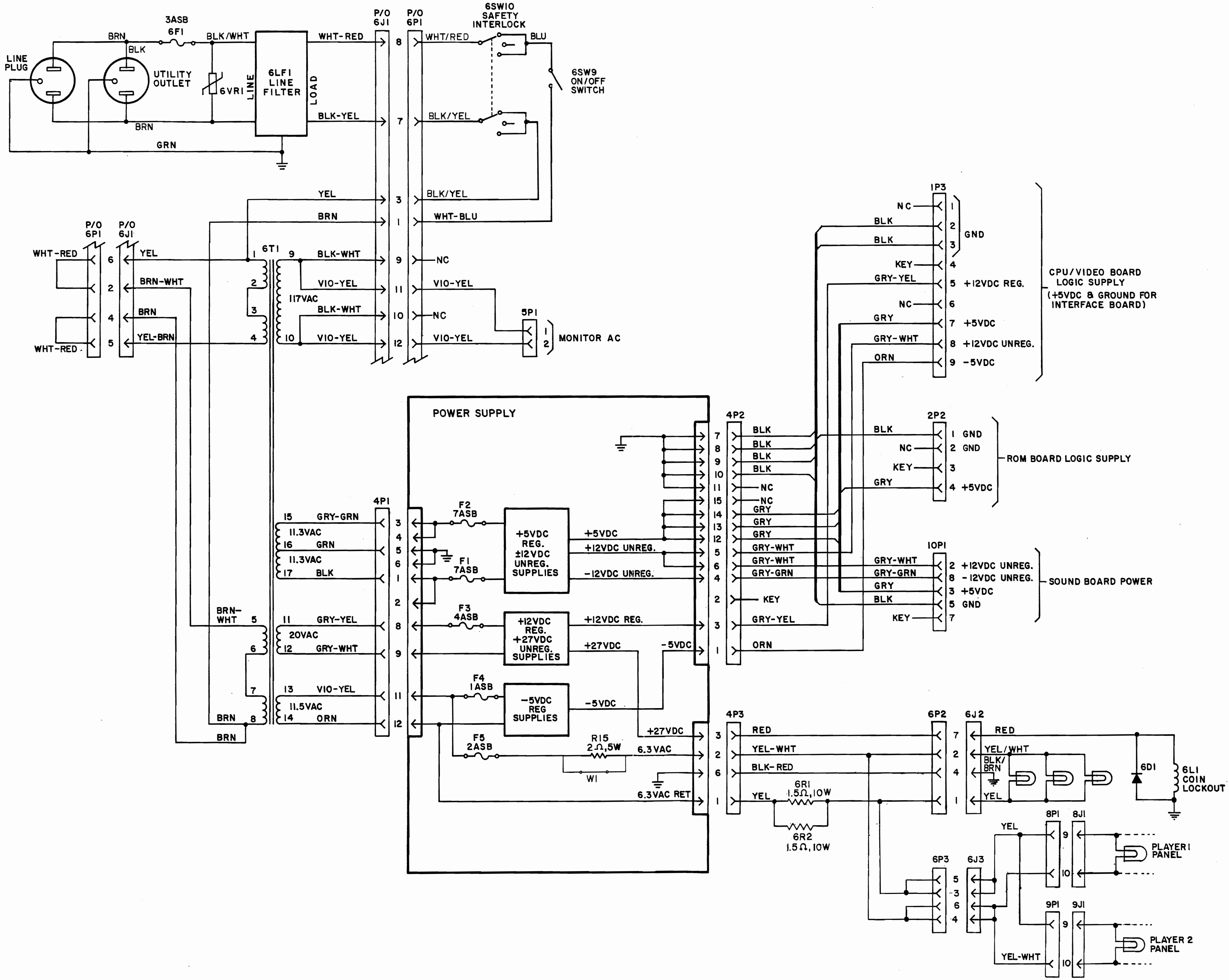
ITEM NO	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D NO.
1	5773-09474-00		P.S. BARE P.C. BOARD	
2	5010-09085-00	R4	RESISTOR, 1.5K 5%, 1/4 W	1
3	5010-09541-00	R8, R7	RESISTOR, 2.7K 2%, 1/4 W,	2
4	5010-09508-00	R 5	RESISTOR, 270 2%, 1/4W	1
5	5010-09428-00	R3	RESISTOR, 1.5K 2%, 1/4W	1
6	5010-09509-00	R11	RESISTOR, 1.1K 2%, 1/4 W	1
7	5010-09510-00	R13	RESISTOR, 12K 2%, 1/4W	1
8	5013-09542-00	R10	RESISTOR, 7.32 K 1%, 1/4W	1
9	5013-09427-00	R1 & R9	RESISTOR 4.99K 1% 1/4 W	2
10	5013-09426-00	R2	RESISTOR 2.15K 1% 1/4 W	1
11	5012-08429-00	R6	RESISTOR .12Ω, 5%, 5W	1
12	5012-09512-00	R14	RESISTOR .27 5%, 5W	1
13	5040-09421-00	C3 & C7	+50% -10% CAPACITOR, 100 MFD, 25V. RADIAL	2
14	5040-09422-00	C2	+50% -10% CAPACITOR, 47 MFD, 50V RADIAL	1
15	5040-09420-00	C6	+50% -10% CAPACITOR, 1000 MFD, 25V. RADIAL	1
16	5040-09419-00	C12	+50% -10% CAPACITOR, 18,000 MFD, 20V. RADIAL	1
17	5040-09423-00	C4	+50% -10% CAPACITOR, 330 MFD, 10V. RADIAL	1
18	5040-09504-00	C13	+50% -10% CAPACITOR, 4700 MFD, 35V. RADIAL	1
19	5043-08996-00	C5, C8, C11	±20% CAPACITOR, .1 MFD, 50V. AXIAL Z5U	3
20	5043-09065-00	C1	±10% CAPACITOR, 470 PFD, 50V. AXIAL X7R	1
21	5043-09492-00	C9	±5% CAPACITOR, 100 PFD 50V. AXIAL 52L	1
22	5040-09506-00	C14	+50%, -10% CAPACITOR, 220 MFD, 16V. RADIAL	1
23	5040-09493-00	C10	+50% -10% CAPACITOR, 22 MFD, 10V. RADIAL	1
24	5070-06258-00	D1, D2, D3	DIODE, IN4001	3
25	5100-09418-00	BR1	BRIDGE RECTIFIER .35 AMP 100V	1
26	5100-09513-00	BR2	DIODE BRIDGE, 4.0A, 50V	1
27	5100-09514-00	BR3	DIODE BRIDGE 1.0A, 50V.	1
28	5731-09432-00	F1, F2	FUSE, 7A SB.	2
29	5731-06314-00	F3	FUSE, 4A, SB., 250 V.	1
30	5731-06569-00	F4	FUSE, 1A, SB	1
31	B-8416-00		HEAT SINK ASSEMBLY (SEE A)	1
32	5705-09543-00		HEAT SINK	1
33	5791-09074-00	4J2	HEADER, 15 PIN, 09-65-1151	1
34	5791-09043-00	4J1	HEADER, 12 PIN, 09-65-1121	1
35	5250-09515-00	Q2	VOLTAGE REGULATOR 7905	1
36	5460-09424-00	IC1, IC2	VOLTAGE REGULATOR 723	2
37	5824-09248-00	TP2, TP3, TP5, TP6	TERMINAL #1502-1 (TEST POST)	4
38	20-9229-00		THERMAL COMPOUND .02 OUNCE	AR
39	4005-01051-07		5-40x7/16 R.H. MECH. SCREW	6
40	4405-01117-00		5-40 HEX NUT	6
41	5161-09552-00	Q1	2N3055 TRANSISTOR NPN	1
42	5731-09651-00	F5	FUSE, 5A, SB	1
43	5791-09038-00	4J3	HEADER, 6 PIN, 09-65-1061	1
44	5012-09544-00	R15	RESISTOR, 2.0Ω, 5%, 5W	1
45	5010-09416-00	R16, R18	RESISTOR, 470Ω, 5%, 1/4W	2
46	5010-09314-00	R17	RESISTOR, 1.2K, 5%, 1/4 W	1
47	5701-09538-00		INSULATOR, MICA, 3mil	1
48	5671-09019-00	LED1, LED2, LED3	LED, RED	3
49	03-7598		INSULATOR, NYLON	2
50	03-7520		TIE WRAP	1
51	5732-09178-00		FUSEHOLDER	10

D8359 Power Supply Board Assembly Drawing



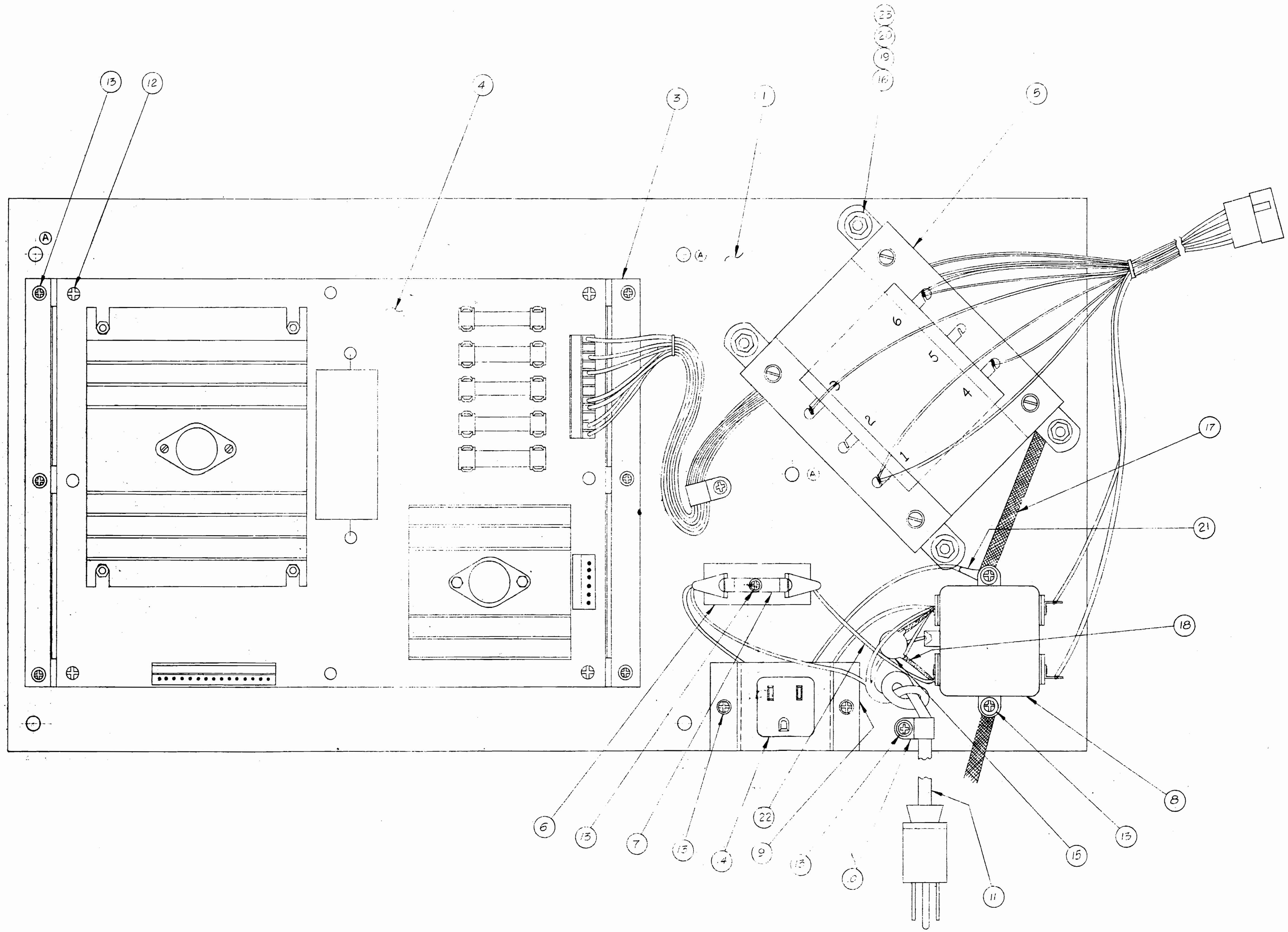
NOTE:
W1 CONNECTED ONLY FOR COCKTAIL APPLICATIONS.

D8359 Power Supply Board
Schematic Diagram



Power Wiring Diagram

BILL OF MATERIAL			
ITEM	PART №.	DESCRIPTION	QTY.
1	11-595	POWER SUPPLY MTG. BD	1
Ⓐ 2			
3	01-7002	POWER SUPPLY SUPPORT BRKT	2
4	D-8359	POWER SUPPLY BOARD	1
5	C-8609	VIDEO TRANSFORMER ASS'Y.	1
6	B-6448-1	FUSE MOUNT ASS'Y.	1
7	5731-08633-00	LINE FUSE 3AMP 115/V	1
8	5102-08895-00	LINE FILTER 5A	1
9	01-[illegible]-18	OUTLET MTG BRACKET	1
10	03-6048-6	CABLE CLAMP-3/8	2
11	SEE NOTE #2	LINE CORD	1
12	4006-[illegible]-04	MS # 6-32 × 1/4 P-RH	4
13	[illegible]-08	SMS # 8-32 × 1/2 P-RWH-A	13
14	5851-[illegible]-00	3 WIRE SNAP-IN OUTLET	1
15	SEE NOTE #1	VARISTOR	1
16	4410-01141-00	NUT 10-24 HEX	4
17	20-9203-3	6 INCH BRAIDED GROUND WIRE	1
18	20-9256	1 INCH SLEEVING INSULATION	2
19	4701-00004-00	# 10 SPLIT WASHER	4
20	4700-00080-00	7/32 I.D. 1/2 O.D. 16 G.A. FLAT WASHER	4
21	5825-06023-00	TERMINAL LUG	1
22	5852-09575-00	BLACK-18 AWG JUMPER WIRE-2.5L	1
23	4310-01141-00	# 10-24 CARRIAGE BOLT × 1 1/4"	4



NOTES:

1. FOR 115V. A.C., 130V. VARISTOR # 5017-09044 IS USED.
   FOR 230V. A.C., A 275V. VARISTOR # 5017-09063 IS USED.
2. LINE CORD PART №.

5850-08728-00 U.S. DOM
5850-06206-00 12 FT. EUROPE
5850-08737-00 AUS.
5850-08743-00 U.S.L.A.
Ⓑ 5850-09123-00 12 FT. FRANCE
5850-09131-00 AWG 18-12 JAPAN

D8608 Power Panel Assembly Drawing

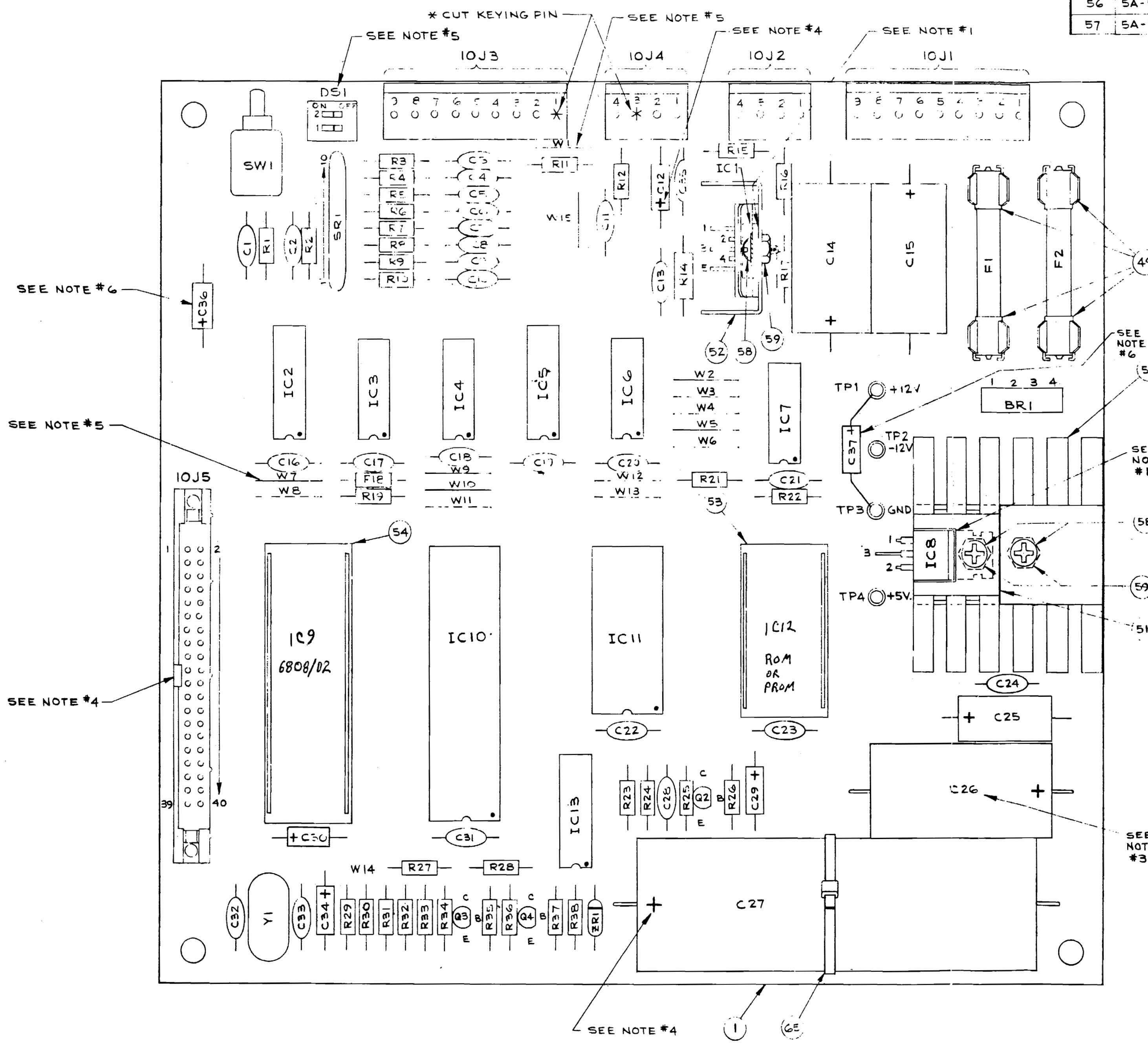
ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
58			6-32 x 3/8" BINDER HEAD SCREW	3
59			6-32 HEX NUT	3
60		W1, W2, W5, W7, W9, W10, W15	WIRE JUMPER 22 GAUGE WIRE WITH INSULATION	7
61	5A-9248	TP1 THR TP4	TERMINAL # 1502-1	4
62	5A-9363	R11	RESISTOR, FC, 5.6 K OHM 5 % 1/4 WATT	1
64	5A-9362	SR1	RESISTOR, 4.7 K OHM 10 PIN SIP	1
65	3A-7520-1		TIE WRAP	1

ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
48	5A 6314	F1, F2	4 AMP SLOW BLOW FUSE	2
49	5A-9178		FUSE HOLDER	4
50	5A-9172		HEAT SINK THERMALLOY #6072B	1
51	5A-9173		HEAT SINK THERMALLOY #6071B	1
52	5A-9199		HEAT SINK THERMALLOY #6030	1
53	5A-9004		24 PIN SOCKET	1
54	5A-8985		40 PIN SOCKET	1
55	5A-9027	10J1, 10J3	9 PIN MALE CONNECTOR	2
56	5A-9028	10J2, 10J4	4 PIN MALE CONNECTOR	2
57	5A-9349	10J5	40 PIN RIBBON HEADER	1

BILL OF MATERIAL

ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
1	1C-2001-146-3		BARE P.C. BOARD	1
2	5A-9156	IC1	TDA2002 V AUDIO AMPLIFIER	1
3	5A-9012	IC2	7442 BCD-DEC DECODER	1
4	5A-9073	IC3	7400 QUAD 2 INPUT NAND	1
5	5A-8973	IC4	7408 QUAD 2 INP. AND GATE	1
6	5A-9153	IC5	4050 BUFFER	1
7	5A-9154	IC6	4068 8 INPUT NAND GATE	1
8	5A-8971	IC7	14069 HEX INVERTER	1
9	5A-9157	IC8	7805 5 VOLT REG. W/TO220 CASE	1
10	5A-8972	IC10	6821 P.I.A.	1
11	5A-9003	IC11	6810 RAM	1
12	5A-9152	IC13	1408 D/A CONVERTER	1
13	5C-8938	Q2, Q3, Q4	2N4401 NPN TRANSISTOR	3
14				
15	5A-9018	ZR1	1N5996 6.8V. ZENER DIODE	1
16				
17	5A-9158 OR 5A-9357	BR1	MDA 200/3N253 BRIDGE RECTIFIER	1
18	5A-9020	Y1	3.58 MHz CRYSTAL	1
19	5B-8991	R1, R18, R19, R21, R22, R27, R30, R31, R32	RESISTOR, FC, 4.7K OHM 5 % 1/4 WATT	9
20	5B-9036	R2 THRU R10	RESISTOR, FC, 100 OHM 10 % 1/4 WATT	9
21	5A-8984	R12, , R15, R28, R36, R38	RESISTOR, FC, 1K OHM 10 % 1/4 WATT	5
22	5A-9181	R14	RESISTOR, FC, 1 OHM 10 % 1/2 WATT	1
23	5A-9161	R16	RESISTOR, FC, 2.2 OHM 10 % 1/4 WATT	1
24	5A-9361	R17	RESISTOR, FC, 220 OHM 10 % 1/2 WATT	1
25				
26	5B-8983	R23, R24, R26	RESISTOR, FC, 3.3K OHM 10 % 1/4 WATT	3
27	5A-9179	R25	RESISTOR, FC, 3.3 M OHM 10% 1/4 WATT	1
28	5A-9359	R29	RESISTOR, FC, 47 K OHM 5 % 1/4 WATT	1
29	5B-8817	R33, R35, R37	RESISTOR, FC, 10 K OHM 10 % 1/4 WATT	3
30	5B-9039	R34	RESISTOR, FC, 10 OHM 10 % 1/4 WATT	1
31	5A-8980	C1, C16 THRU C23 C31	CAPACITOR, CERAMIC, .01 MFD. 50 V. ±20%	11
32	5A-9065	C2 THRU C10	CAPACITOR, CERAMIC, 470 PFD. 50 V. ±20%	9
33	5A-9345	C11	CAPACITOR, CERAMIC, .001 MFD. 20% 100 V.	1
34	5A-9365	C12, C30, C36	CAPACITOR, *ELECTROLYTIC* 1 MFD. 63 V. -10/+ 50%	3
35	5A-8996	C13, C24, C35	CAPACITOR, CERAMIC, .1 MFD. 50 V. ±20%	3
36	5A-9165 5A-9165-1	C14	CAPACITOR, ELECTROLYTIC, 800 MFD. 16 V. OR 1,000 MFD. 15 V. ±20%	1
37	5A-9164 5A-9164-1	C15	CAPACITOR, ELECTROLYTIC, 500 MFD. 15 V. OR 470 MFD. 25 V. ±20%	1
38	5A-8986	C25	CAPACITOR, ELECTROLYTIC, 100 MFD. 10 V. ±20%	1
39	5A-8893	C26,	CAPACITOR, ELECTROLYTIC, 1,000 MFD. 25 V. ±20%	1
40	5A-9046	C27	CAPACITOR, ELECTROLYTIC, 12,000 MFD. 16 V. ±20%	1
41	5A-9180	C28	CAPACITOR, CERAMIC, 47 PFD. 1K V. ±20%	1
42	5A-9343	C29	CAPACITOR, ELECTROLYTIC, 10 MFD. 25 V. LOW LEAK ±20%	1
43	5A-9169	C32, C33	CAPACITOR, CERAMIC DISC, 27 PFD. 1K V. ±10%	2
44	5A-9163	C34	CAPACITOR, TANTALUM, 2.2 MFD. 15 V. ±20%	1
45	5A-9031	C37	CAPACITOR, TANTALUM, 1 MFD. 25V. ±20%	1
46	5A-9024	SW1	MOMENTARY SWITCH SPDT	1
47	5A-9330	DS1	2 STD. DIP SWITCH	1

TOLERANCES UNLESS OTHERWISE SPECIFIED		QTY.	ASSEMBLE ON
FRACTIONAL ±1/64"	WILLIAMS ELECTRONICS, INC. SUBSIDIARY OF THE SEEBURG CORP. 3401 N. CALIFORNIA CHICAGO, ILL. 60618 267-2240		
DECIMAL ±.005"; HOLE DIA. +.002 −.000"	NAME SOUND BOARD SUB-ASSEM		
ANGULAR ±1/2°; CONCENTRICITIES T.I.R. .003"; SCREW THREADS CLASS 2	MATERIAL	HEAT TREATMENT	FINISH
DWN. RGH	DATE 9-23-79	APP'D. 10/10/79	SCALE 2:1 — D-8223



NOTES:

1. USE THERMAL COMPOUND BETWEEN IC8 AND HEAT SINK.
2. CAUTION: AVOID STATIC DISCHARGE DAMAGE TO MOS LOGIC.
3. SYMBOLS SHOWN ON COMPONENTS ARE FOR REFERENCE ONLY. DO NOT SCREEN OR STAMP.
4. OBSERVE INDEX MARK OF ALL INTEGRATED CIRCUITS, DIODES D1, D2, AND ZR1. CAPACITORS C12, C14, C15, C25, C26, C27, CONNECTORS 10J1, 10J2, 10J4, 10J3, 10J5, POSITION OF TRANSISTORS Q1, Q2, Q3, Q4.
5. DS1 - 1 SELECTS SOUNDS/NOTES
   2 SELECTS SPEECH/NO SPEECH (W9/W4)
   W1 - SPEECH MODULE STATUS
   IN - SPEECH MODULE NOT ATTACHED
   OUT- SPEECH MODULE ATTACHED
   W14 - MPU INTERNAL RAM ENABLE
   W7 & W8-MEMORY MAP CONTROL
   W12 & W13 - PB7 STATUS CONTROL (W13 NEVER USED)
   W4 & W9 - PB5 STATUS CONTROL
6. SOLDERED ON TOP OF BOARD

INSTAL THESE JUMPERS FOR FOLLOWING GAMES:

W15, W8, W12, W4, W1, W3, W6, W11 FOR:

WORLD CUP
DISCO FEVER
CONTACT
POKERINO
PHOENIX
ARISTOCRAT SHUFFLE
POMPEII SHUFFLE
KING TUT SHUFFLE
TAURUS SHUFFLE
} SOUND ROM 1

W15, W8, W12, W4, W1, W2, W5, W10, FOR:

FLASH
STELLAR WARS
TRI ZONE
TIME WARP
} SOUND ROM 1 5A-9198

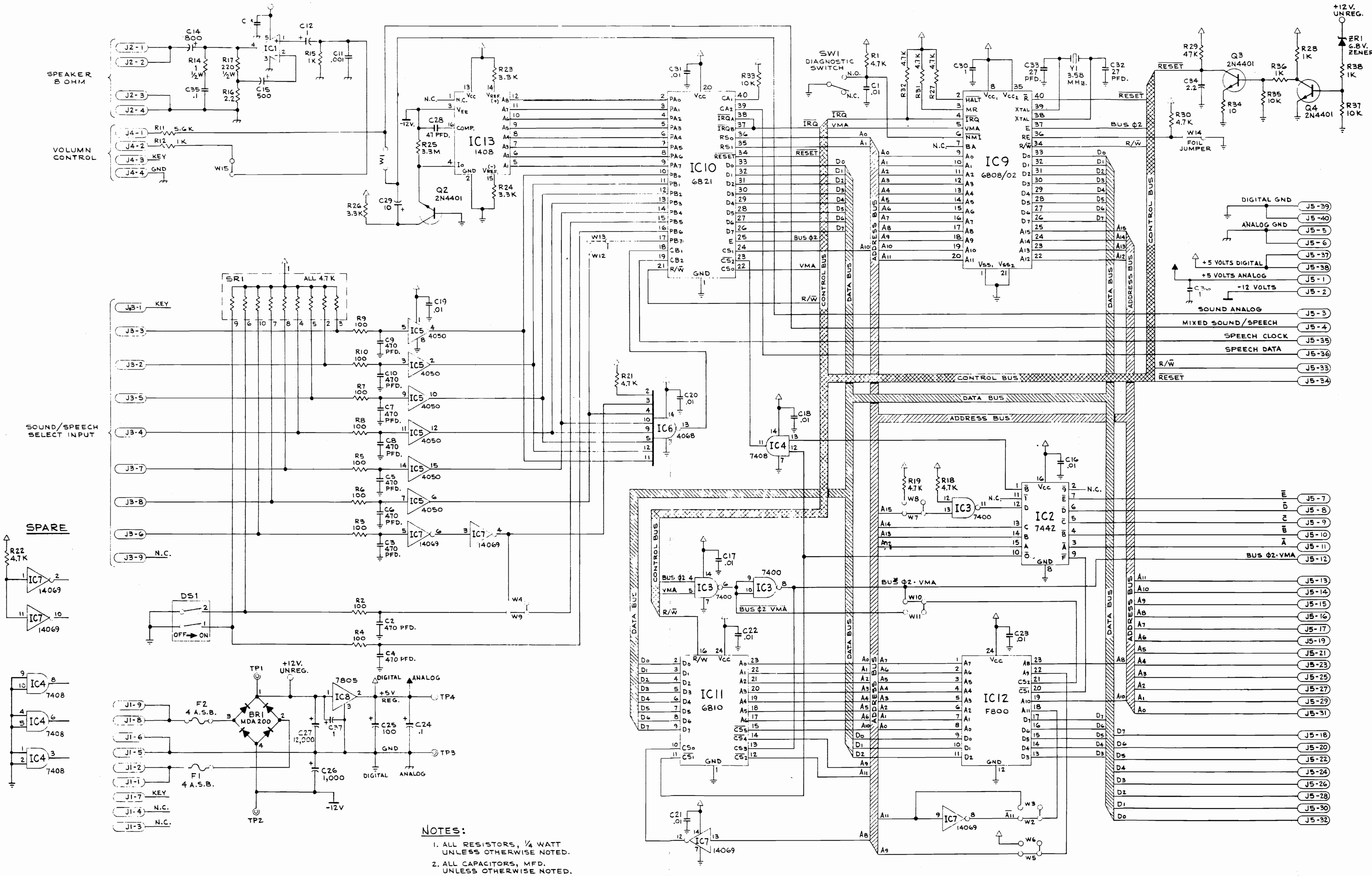
W7, W15, W9, W1, (SEE NOTE #5) W2, W5, W10 FOR:

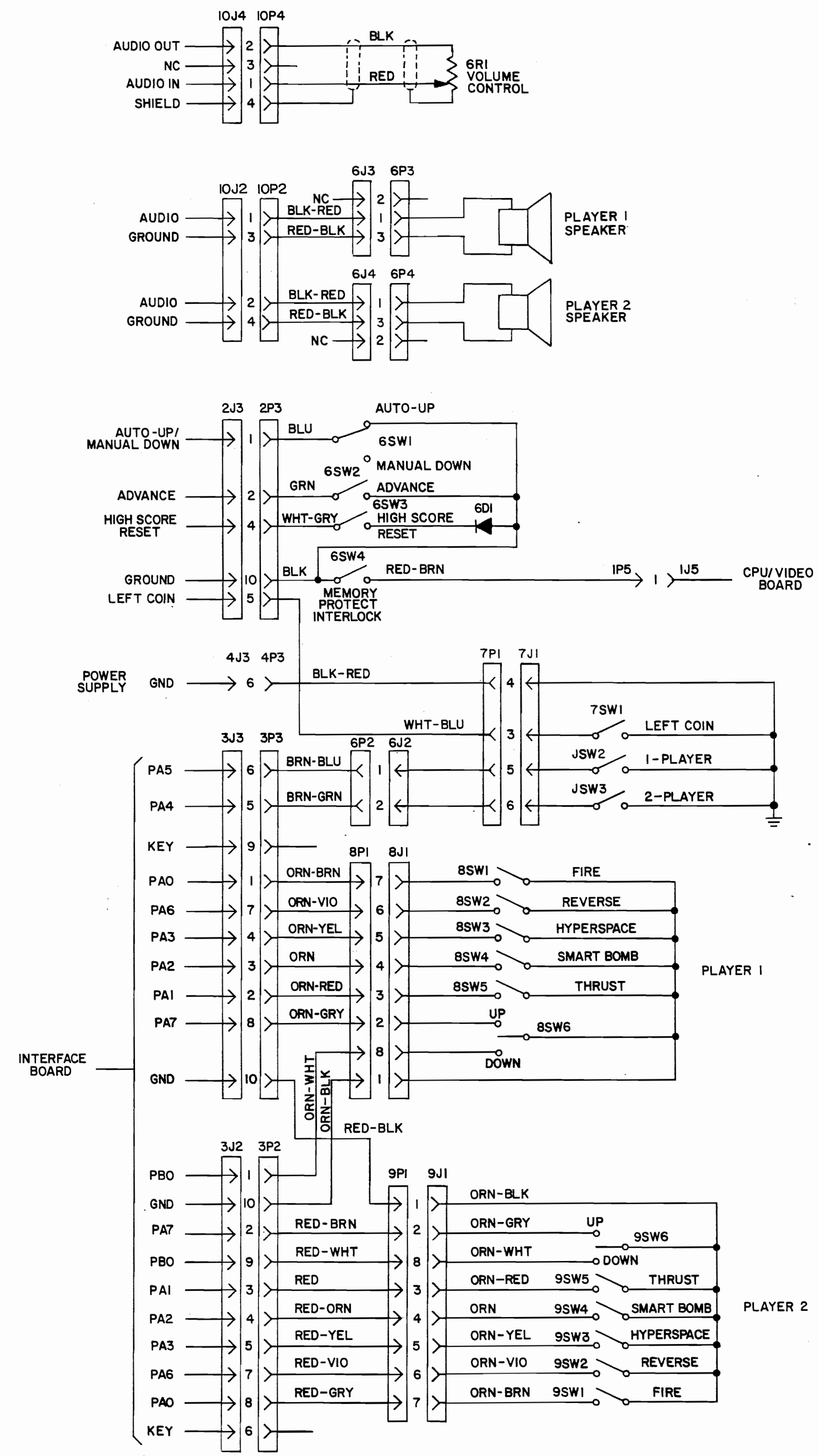
GORGAR; SOUND ROM 2 - 5T-4960

IC 12 SELECTION STRAPPING:

(2K x 8)	(4K x 8)	(512 x 8)
W2	W3	W3
W5 IN	W5 IN	W5 IN
W11	W11	W11

D8224 Sound Board Assembly Drawing


SPEAKER 8 OHM
VOLUMN CONTROL
SOUND/SPEECH SELECT INPUT
SPARE
SW1 DIAGNOSTIC SWITCH
IC13 1408
IC10 6821
IC9 6808/02
IC6 4068
IC4 7408
IC5 4050
IC7 14069
IC3 7400
IC2 7442
IC11 6810
IC12 F800
IC8 7805
Q2 2N4401
Q3 2N4401
Q4 2N4401
BR1 MDA 200
ZR1 6.8V. ZENER
Y1 3.58 MHz.
SR1 ALL 4.7K
DS1
OFF ON
TP1
TP2
TP3
TP4
+12V. UNREG.
-12V
DIGITAL
ANALOG
+5V REG.
F1 4 A.S.B.
F2 4 A.S.B.
W14 FOIL JUMPER
CONTROL BUS
DATA BUS
ADDRESS BUS
DIGITAL GND
ANALOG GND
+5 VOLTS DIGITAL
+5 VOLTS ANALOG
-12 VOLTS
SOUND ANALOG
MIXED SOUND/SPEECH
SPEECH CLOCK
SPEECH DATA
BUS Φ2 · VMA
NOTES:
1. ALL RESISTORS, 1/4 WATT UNLESS OTHERWISE NOTED.
2. ALL CAPACITORS, MFD. UNLESS OTHERWISE NOTED.



Cabinet Wiring Diagram